



Fall Armyworm *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae): Damage Symptoms and Identification.

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Introduction

- Fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae)
- Destructive pest native to Americas.
- African continent - January 2016 (Goergen *et al.* 2016).
- Spread into 43 African countries.
- India : Shivamonga, Karnataka – 18th May 2018 (Ganiger *et al.* 2018 and Sharanabasappa *et al.* 2018).
- Srilanka, Bangladesh, Myanmar, Thailand, Vietnam, China, Taiwan, South Korea, Japan.
- Nepal: Gaidakot of Nawalpur District (N 27°42'16.67" E 84°22'50.61") on 9th May 2019.

अमेरिकी रैथाने फौजी कीरा नेपालमा

■ गोरखापत्र समाचारदाता

काठमाडौं, जेठ १२ गते । बालीनालीमा लाग्ने अमेरिकी रैथाने फौजी कीरा नेपालमा पनि फेला परेको छ ।

नेपाल कृषि अनुसन्धान परिषद् अन्तर्गतको किट विज्ञान महाशाखाले अनुसन्धान गरी सो कीरा फेला पारेको हो । अन्नबालीमा व्यापक रूपमा नोक्सानी पुऱ्याउन सक्ने सो कीरा अमेरिकामा पाइने रैथाने कीरा रहेको महाशाखाका वरिष्ठ वैज्ञानिक अजयश्री रत्न बज्राचार्यले जानकारी दिनुभयो । मुख्यतः मकै मन पराउने यो कीराले मकै नपाएको अवस्थामा जुनेलो, धान, गहुँ, कोदो, उखुबाली, बन्दा, चुकन्दर, बटाम,

भटमास, प्याज, कपास, गोलभेडा, आलुबाली तथा घाँसेबालीमा समेत व्यापक रूपमा क्षति पुऱ्याउने गरेको उहाँले जानकारी दिनुभयो ।

महाशाखाद्वारा आइतबार आयोजित पत्रकार सम्मेलनमा उहाँले यो कीरा छिटो तथा आक्रमक रूपमा एक ठाउँबाट अर्को ठाउँमा सरेर भएकाले अमेरिकाबाट नाजेरिया, अफ्रिका, ब्राजिल लगायत भारत हुँदै नेपाल आएको जानकारी दिनुभयो । अमेरिकापछि पहिलो पटक सन् २०१६ को जनवरीमा नाइजेरियामा यो कीरा फेला परेको थियो । अहिले यो कीरा ४० अफ्रिकी मुलुकमा फैलिसकेको छ । यसले सन् २०१७ अफ्रिका महादेशको मकै उत्पादन गर्ने १२ देशमा मात्र चार करोड जनसङ्ख्यालाई असर गरेको थियो ।

यस कीराबाट एक वर्षमा त्यहाँ झण्डै ६.१९ अर्ब अमेरिकी डलर बराबरको आर्थिक नोक्सानी भएको वैज्ञानिक बज्राचार्यले जानकारी दिनुभयो ।

सन् २०१८ मा पहिलो पटक भारतको कर्नाटकमा सो कीरा फेला परेको थियो । त्यसपछि बङ्गलादेश, श्रीलङ्का, भियतनाम, थाइल्यान्ड तथा चीन लगायत ३० भन्दा बढी देशमा यो प्रवेश गरिसकेको छ । भारतमा फेला परेकै बेला यो कीरा नेपाल पनि जानसक्छ भनि आशङ्का गरेको थियो । डेढ वर्षअघि गुजरातमा भएको एक अन्तर्राष्ट्रिय सम्मेलनमा भाग लिन नेपाली प्रतिनिधि पनि गएका थिए । त्यहाँ त्यो कीराको बारेमा चर्चा हुँदा नेपालमा पनि जान सक्छ भन्ने चर्चा भएको थियो ।

FAW distribution within Nepal



- Nawalpur.
- Chitwan.
- Lalitpur
- Sindhupalchowk
- Kavrepalanchowk
- Dolakha (1700 masl)
- Sindhuli
- Ramechhap
- Okhaldhunga
- Khotang
- Bhojpur
- Banke
- Rolpa
- Pyuthan
- Salyan



Suk Bahadur Gurung is with Narayan Dhimi and 2 others.

29 Jun at 21:35 • 🧑🏿

सार्वजनिक हितको लागि पहाडी बाली अनुसन्धान कार्यक्रमको पहललाई Usha Tamang ले उज्यालो अनलाइन सम्म पुर्याउनु भएकोमा धन्यवाद । सम्बन्धित सबैमा यो जानकारी पुगोस, कम भन्दा कम क्षति होस, समयमै उपचार मिलाओ र यस्ता बिपत्तीमा सबै एकताबद्ध भएर सहि समाधान निकाल्न सकियोस ।



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दोलखामा लगाइएको मकैबालीमा फौजी किराको प्रकोप

दोलखा - मेलुङ गाउँपालिकाको पवटि, वैत्येश्वर गाउँपालिकाको काब्रेल...



Host Plants

- Maize
- 80 different crop species (FAW in Africa, 2018).
- 353 plants larva host: 76 families (Poaceae 106, Asteraceae 31, Fabaceae 31) (Debora, 2018)
- Sorghum, rice, wheat, finger millet, sugarcane, fodder grasses.
- Cabbage, beet, groundnut, soybean, onion, cotton, tomato and potato etc.



Dispersal and Migration

- Strong flier
- Migratory and localized dispersal habit.
- Can fly 100 km in search of host.
- Migrate 500 km before oviposition.
- 1800 km from Mississippi to Southern Canada in 30 hours (Rose *et al.* 1975)



Losses caused

- Yield loss of maize (20.15 %), sorghum (7.45 %), paddy (56.15 %) and sugarcane (51.05 %): US\$ 13,383 million in African countries (Abraham et al., 2017).
- Maize yield reduction caused 34 % in Brazil (Cruz et al., 1999)



Maize in Nepal

- 891,583 ha and 2.231,517 m t production (Statistical information, 2017).
- 18.95 % in terai and 81.04 % in hills (Statistical information, 2017).
- 670,000 mt maize deficit in Nepal (Govinda et al., 2015).

Damage Symptoms Observed.



Early Instar Damage (Papery window)



Ragged hole damage symptoms



Damage in whorl



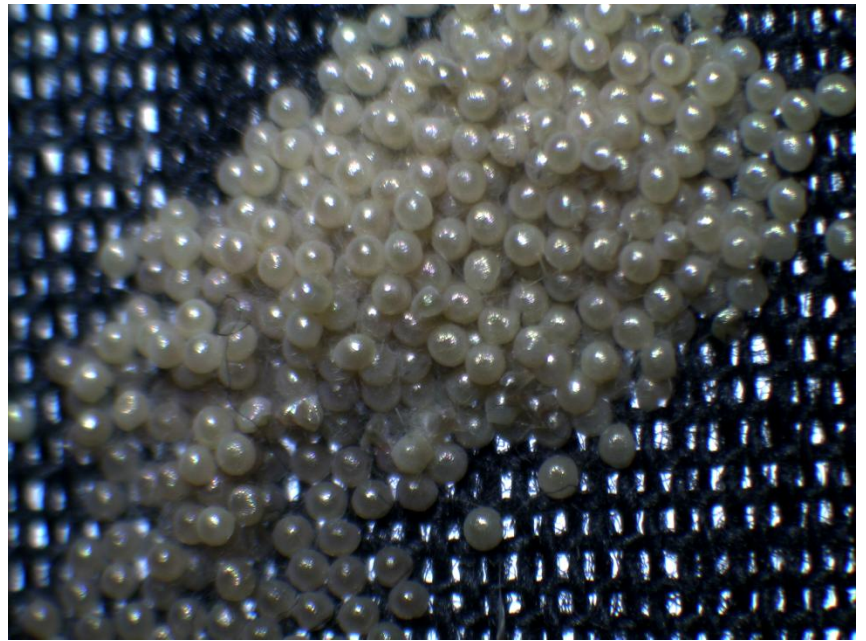
Damage in tassel and silk



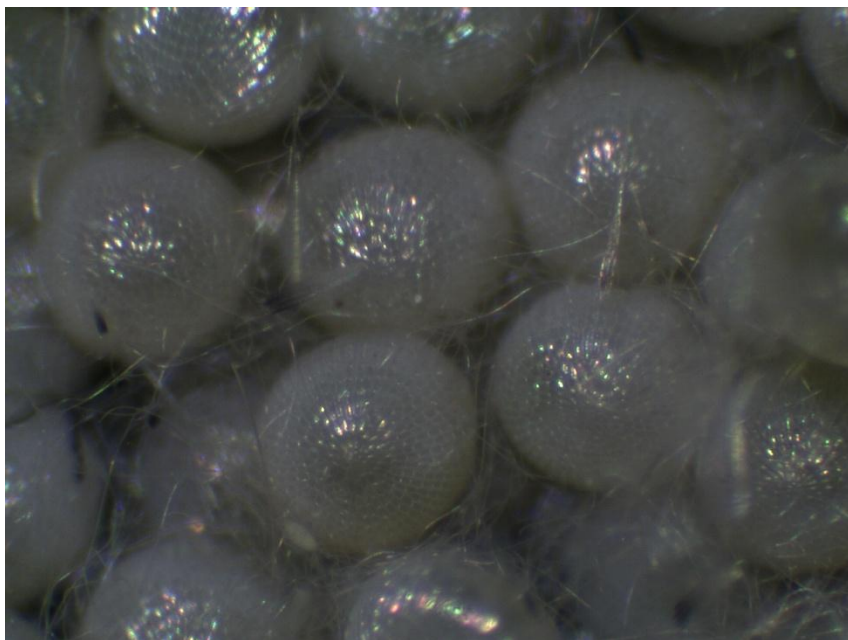
Damage in maize cob



Egg



...Eggs



- Eggs laid in group.
- 100 above
- Overlapping two or more layers.
- Covered with abdominal hair .
- Reticulate ribs.
- Wider than height.
- Creamy white .

Early instar larvae



- Whitish color, later change into green.
- Dorsal stripes could be seen
- Pinnacula prominent with hairs.

Mature larva with various identification characters.



- Dorsal pinacula in 8 square and 9 abdominal segment trapezoid, larger than other segments
- Inverted “Y” :ecdysial line + prothoracic line
- Dorsal faint color 3 lines
- Prothoracic plate and head similar color.

Color differences of FAW larvae



Color differences of FAW larvae



Color difference in FAW larvae



Pupa

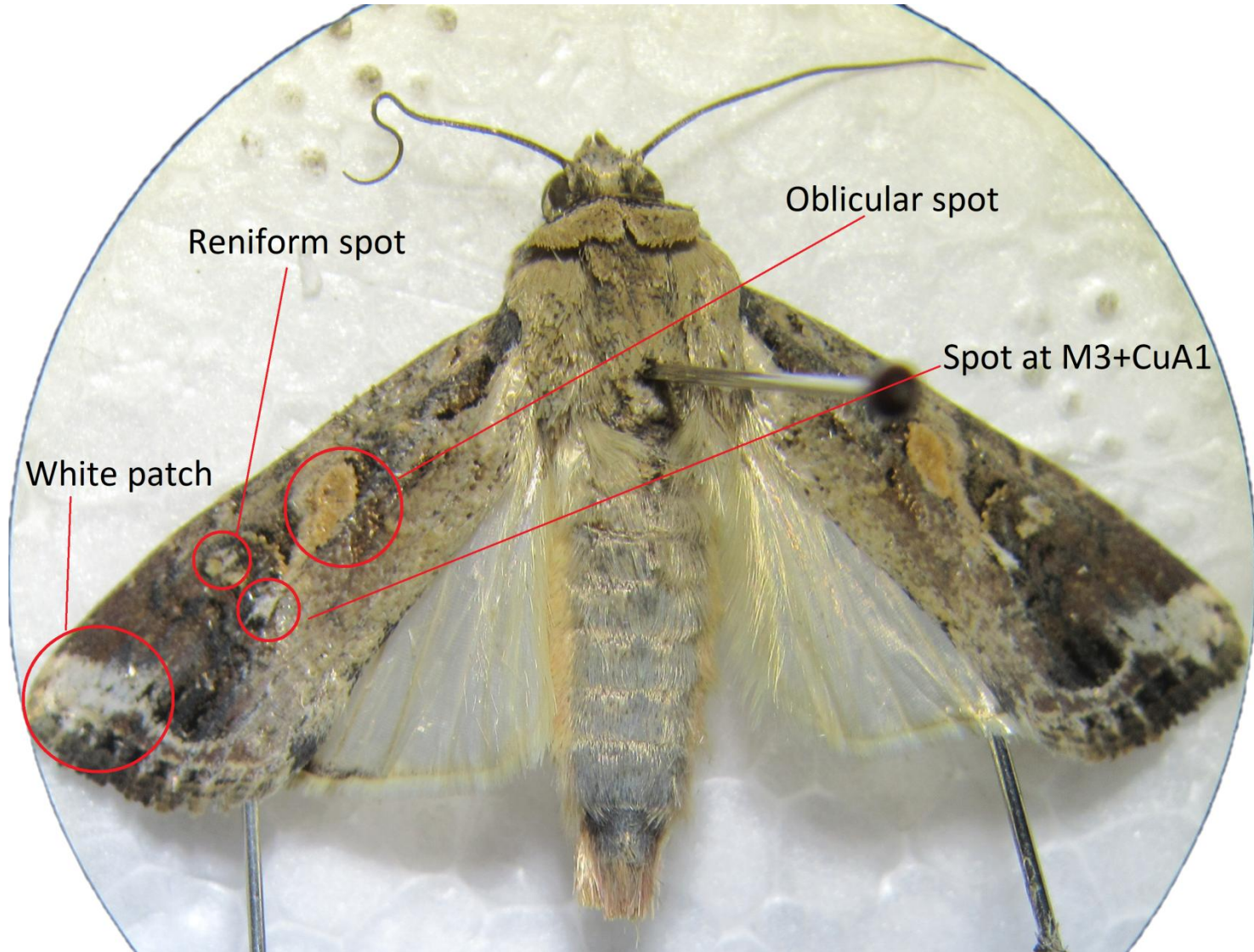


Pupa obtect, two spines in cremaster

Adult male



Adult male with identification marks



Adult female

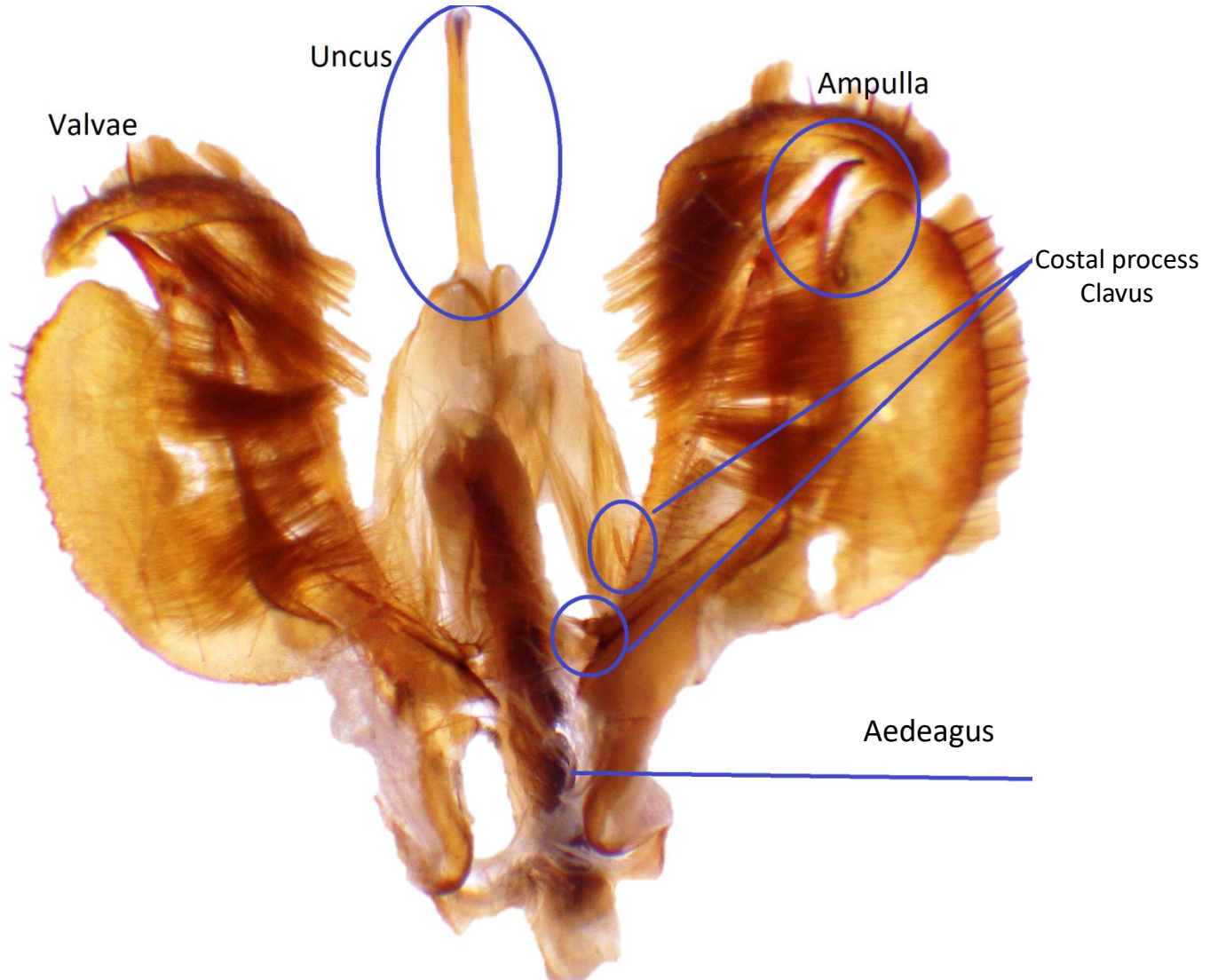
© Ajaya Shree Ratna Bajracharya.



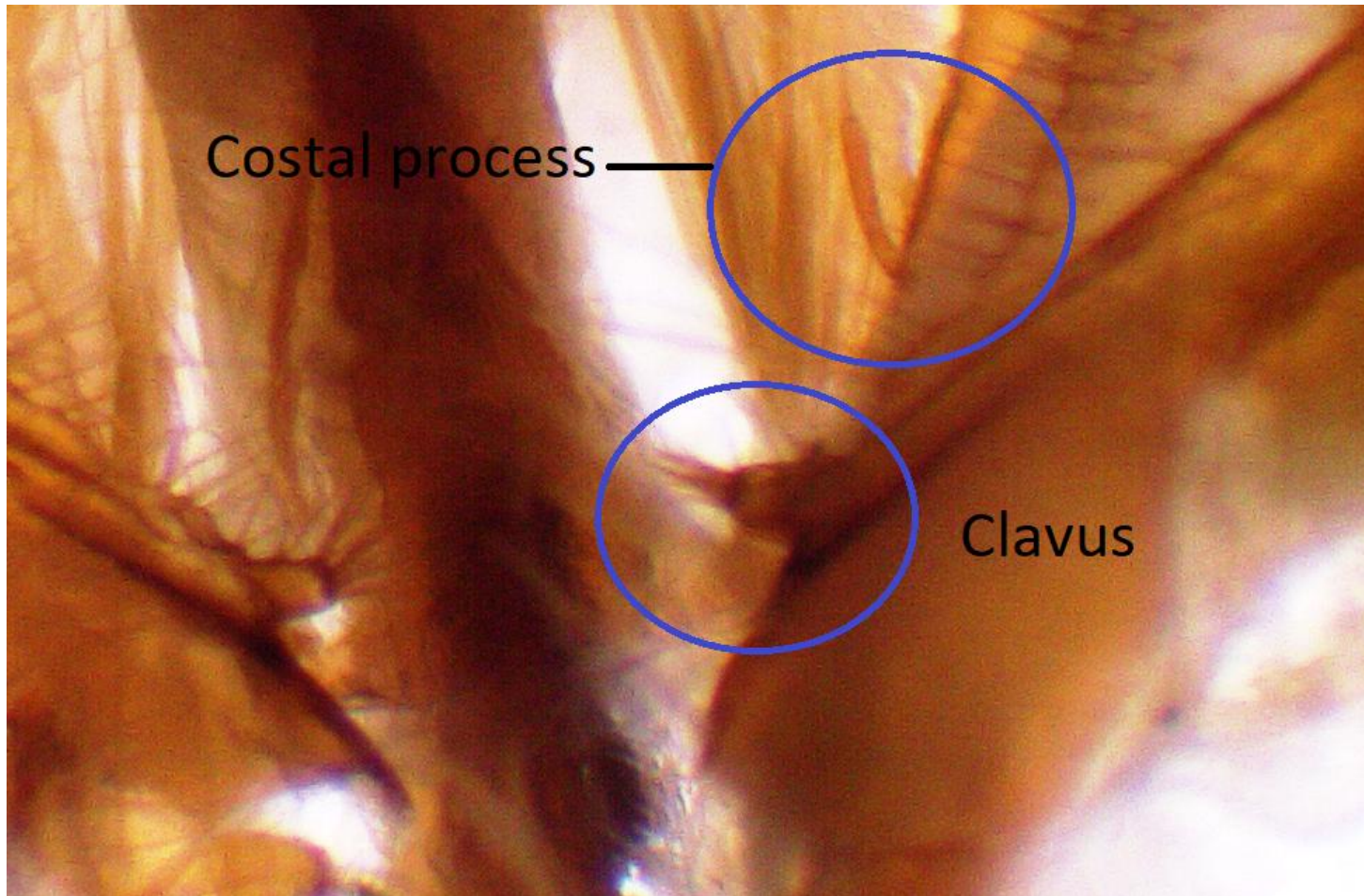
Adult female



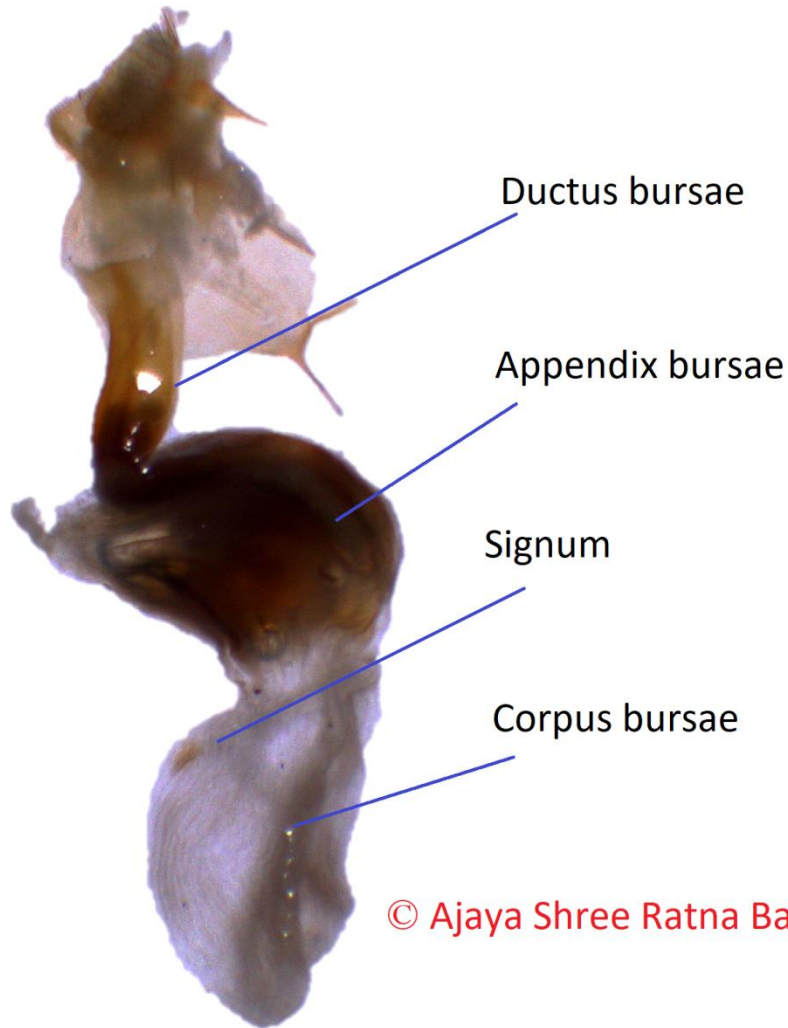
Male genitalia



Costal process : Small, narrow, elongate, straight, inclined hair at tip
Clavus: short



Female genitalia



- Ductus bursae completely sclerotized.
- Appendix bursae partially sclerotized.
- Corpus bursae bulbous, length less than twice width; striate convolutions.
- Signum in basal half of corpus bursae

Molecular study

Description	Max Score	Total Score	Query Cover	E value	Per Ident	Accession
<input type="checkbox"/> Spodoptera frugiperda voucher SFBSWRJ cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MK933908.1
<input type="checkbox"/> Spodoptera frugiperda cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MK591010.1
<input type="checkbox"/> Spodoptera frugiperda strain Pune cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MK285364.1
<input type="checkbox"/> Spodoptera frugiperda strain hassan cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH881533.1
<input type="checkbox"/> Spodoptera frugiperda strain Bellur cytochrome c oxidase subunit 1 gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH881532.1
<input type="checkbox"/> Spodoptera frugiperda strain SHIMOGA cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH881531.1
<input type="checkbox"/> Spodoptera frugiperda strain Rajendranagar cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH881530.1
<input type="checkbox"/> Spodoptera frugiperda strain Siddipet cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH881529.1
<input type="checkbox"/> Spodoptera frugiperda strain Nagarkurnool cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH881528.1
<input type="checkbox"/> Spodoptera frugiperda strain Khammam cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH822835.1
<input type="checkbox"/> Spodoptera frugiperda strain Nelivada cytochrome c oxidase subunit 1 (COX1) gene, partial cds, mitochondrial	1074	1074	100%	0.0	99.83%	MH822835.1

- *mtCOI* DNA sequence of larvae.
- Sequence assessments Basic Local Alignment Search Tool (BLAST) of NCBI (National Center for Biotechnology Information) (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>).
- Genetic sequence of Nepal sample resembled above 99 percent with more than 200 NCBI database of *Spodoptera frugiperda*.
- India, Kenya, Dominican Republic, Uganda, Costa Rica, USA, Canada, Brazil, South Africa, Ghana and China.

(N4_LCO_21322-6_P2933, Trimmed Sequence(584 bp))

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•TTAGGAACCCAGGATCTTTAATTGGAGATGATCAAATTTATAACTATTG
TAACAGCCCATGCTTTTATTATAATTTTTTATAGTTATACCAATTATAATTG
GAGATTGGAAATTGACTTGTACCTTTAATATTAGGAGCTCCTGATATAGC
TTTCCCACGTATAAATAATATAAAGTTTTTGTACTTTTACCCCATCTTTAACTTT
ATTAATTTCTAGTAGCATTGTAGAAAATGGAGCAGGAAGCTGATGAACAGT
TTACCCCCCTCTCCTCTAATATTGCTCATGGTGGTAGTTCAGTAGATTTAG
CTATTTTCTCACTTCATTTAGCTGGAATTTCACTATTTTAGGAGCTATTAAC
TTATTACCACTATTATAATATACGATTAATAATTTATCATTTGATCAAATAC
CTTTATTTATTTGAGCTGTAGGTATTACCGCATTTTTATTATTATTATCTTTACC
TGTTTTAGCTGGAGCTATTACTATATTACTTACTGATCGAAATCTAATACATC
ATTTTTCGATCCTGCAGGAGGAGGTGATCCTATTCTTTATCAACATTTATTT
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The screenshot shows a web browser window displaying the NARC website. The page title is "The first record of Fall Armyworm Spodoptera frugiperda in Nepal". The URL is "narc.gov.np/the-first-record-of-fall-armyworm-spodoptera-frugiperda-in-nepal/". The page features the NARC logo and the Nepali text "नेपाल सरकार" and "नेपाल कृषि अनुसन्धान परिषद्". The main content area includes the names of the scientists: Ajaya Shree Ratna Bajracharya (Senior Scientist) and Binu Bhat (Technical Officer), and their affiliation: Entomology Division, Nepal Agricultural Research Council. A paragraph describes the Fall armyworm (*Spodoptera frugiperda*) as a destructive pest of cereal crops. A search bar is visible on the right side of the page. The Windows taskbar at the bottom shows the time as 3:26 PM on 7/14/2019.



- External morphology, genitalia and DNA sequencing.
- Ganiger *et al.* 2018, Sharanabasappa *et al.* 2018, Sparks *et al.* 2018, EPPO bulletin 2015, Juliet and Brambila 2009 and Juliet and Brambila 2013, Pogue 2002.

Life cycle study at laboratory conditions

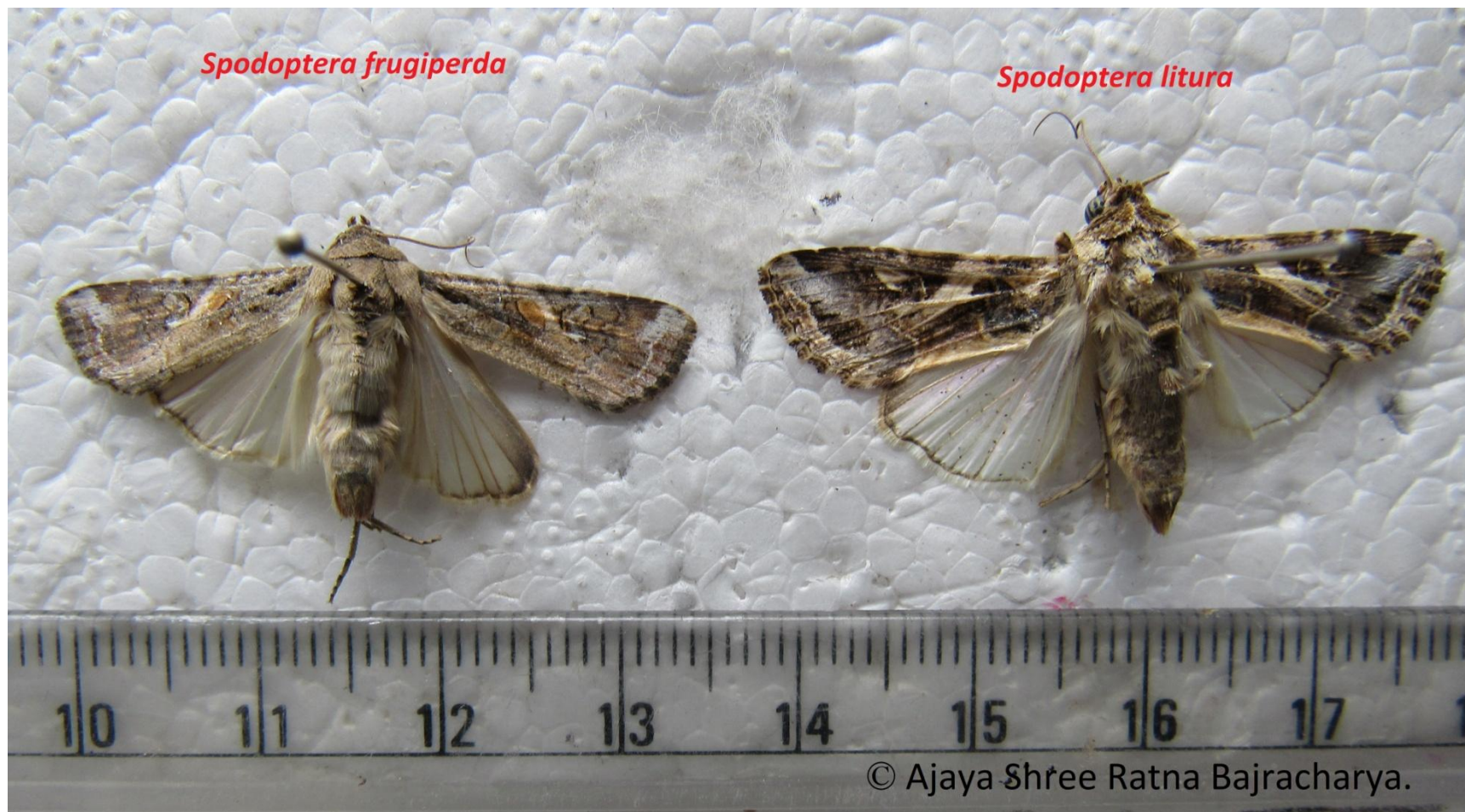


Insecticides found effective



- Spinosad 45 % SC.
- Chlorantraniliprole 18.5 % SC.
- Emamectin benzoate 5 % SG.

Differences between FAW and tobacco caterpillar adult male



Difference between FAW and tobacco caterpillar larvae



Spodoptera frugiperda

© Ajaya Shree Ratna Bajracharya.

Spodoptera litura

© Ajaya Shree Ratna Bajracharya.

Difference between FAW and oriental armyworm adult.



Difference between FAW and Oriental armyworm larva





Thank you.